

GENERAL DOWNRANGE POWER & DATA REQUIREMENTS

Function: This section shall explain the general design requirements for the downrange power and data distribution to control Next Generation Army Target System (NGATS) range targetry and its associated equipment.

General Summary: All targetry will be controlled over Ethernet based networks. These networks will be comprised of a combination of fiber optics and copper based systems maximizing the use of Commercial off the Shelf (COTS) electronic components and standards.

Power Requirements: Electrical power distribution shall conform to the Architectural Engineering Institute (AEI) and Technical Manual (TM)) 5-811-1. Voltage regulation and/or metering may be required. The voltage supplied must be maintained within 5% at a frequency of 60Hz, +/-0.5; the design agency shall verify the power supply for each site. Voltage available to each target shall be no less than 95 percent of the target's rated operating voltage.

Environmental Limits: The temperature and humidity limits for electronic equipment are as follows:

- a. Indoor equipment operating temperature shall be: + 21.1°C (70°F) to +25.6°C (+78°F). Non-operating temperature should be: -34.44°C (-30°F) to +65.56°C (+150°F). Humidity should be between 10% - 80% RH non-condensing.
- b. Outdoor equipment non-operating and operating temperature shall be: -34.44°C (-30°F) to 60°C (140°F). Humidity: 5% to 95% RH (non-condensing).

Burial Methods: Downrange power distribution and data cable shall be direct buried or run underground in conduit. Direct burial distribution is the recommended method since it is less costly than conduit methods. The direct burial cables must be encased in a bed of sand or select backfill. Whenever crossing under road systems a concrete encased ductbank will be installed. The method of "plowing" cables is not recommended. The power and data cables shall also be installed in the same trench adhering to the Mandatory Center of Expertise required separation distances as listed below. Unexploded Ordinance (UXO) and environmental issues should be considered to determine routes before trenching to minimize disturbance of effected areas. The designer should route trenches along access roads and maintenance trails as much as practical to minimize disturbance. Concrete encased duct banks must be used whenever trenching underneath road systems. Actual depth of the cables shall be deep enough to prevent damage from projectile

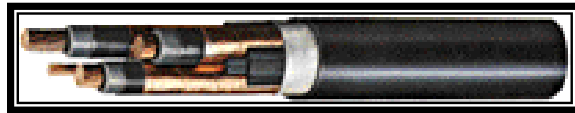


penetration. Minimum cover requirements of National Fire Protection Agency (NFPA) 70 and American National Safety Institute (ANSI) must be met See the Electrical Details in the Appendix of this document for details.

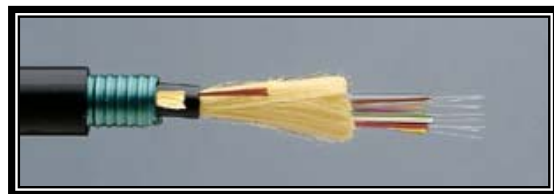
- a. Direct burial armored fiber optic or CAT5E or better cabling and secondary power cables must maintain a 102-millimeter (four inch) separation distance.
- b. Direct burial armored fiber optic or CAT5E or better cabling and primary power cables must maintain a 305-millimeters (twelve inch) separation distance.

Direct Burial Cabling Requirements:

- a. **Power Cable.** The size of the power cables depends on the number of targets served, circuit voltage drop, and the circuit protective device rating. Operating voltage at the most distant emplacement or target should not be less than 95 percent of the supplying transformer's secondary voltage. The primary distribution power cable shall be three conductor (multi-conductor) with an overall shield and an enclosing jacket conforming to NEMA WC-7 or WC-8. The secondary power cable shall be a 600-volt rated, multi-conductor cable. It shall consist of insulated, stranded, copper conductors and a bare, stranded, copper grounding conductor. Each cable shall be enclosed within a tight fitting, heavy, nonmetallic jacket suitable for direct burial. In instances where the secondary power cable enters a NEMA 4, NEMA 4X, or NEMA 6P rated enclosure, the power cable shall be a 600-volt rated multi-conductor cable filled until rounded with non-wicking fillers and be enclosed within a tight fitting, heavy, nonmetallic jacket suitable for direct burial. The size of the conductors terminated in the Load Center (LC) at the emplacement shall not exceed No.2 AWG. Emplacements with larger size load centers than a Stationary Infantry Target (SIT) may use larger size conductors, not to exceed what is recommended by the manufacturer. No splicing of cables between emplacements is allowed.



- b. **Data Cable.** The type of data cable used depends on the range and network design. If metallic conduit is used the armored or shielded jacket is not required. The fiber optic data cable shall be multi-strand multi-mode/single mode, Outside Plant (OSP) direct burial, Ultraviolet (UV) resistant, single armored, water-blocking, gel-filled, loose-tube, double-jacketed. The CAT5E or better data cable shall be Shielded Twisted Pair (STP), Outside Plant (OSP) direct burial, UV resistant, rodent proof, water-blocking. The only allowable splicing of either type of cable is in the emplacement



Master Target Data Panel (MTDP) or Target Data Panel (TDP). When splicing, fiber optic strands will be fusion spliced. CAT5E or better data cable splices shall have a low connection resistance, high insulation resistance, and resistance to moisture and corrosion. All cables shall be terminated with the appropriate connectors and tested. When terminating, fiber optic cables shall be terminated with “SC” type connectors. When a fiber optic cable enters the MTDP, a minimum of 4 strands of the 6 strand fiber optic cable shall be terminated on each of the incoming and exiting fiber cables; the additional 2 strands for each fiber cable should then be spliced in the MTDP in a splice tray. All 6 strands shall be terminated when only a single six strand fiber optic cable enters the MTDP. As an option, all 6 strands of fiber may be terminated on the incoming and exiting fiber cable in each MTDP versus splicing only the 2 additional strands. CAT5E or better data cable shall be terminated with a data surge protector terminal block. The finished installation of the data cable shall provide a RJ-45 female connector to allow future connection of others via RJ45 connectors. Innerduct is not required at the emplacement, but is required to be installed in the Range Operations Center (ROC) entry conduits and in conduits placed in ductbank located beneath roadways and trails.

- c. Data Surge Protector Terminal Block Equipment. Provide surge protection circuitry on both ends of CAT 5E data cables installed between ROC and ARR, ROC and target emplacements, between two target emplacements, and between control pedestals and remote communication enclosures (UAC). The device shall comply with UL 497 or UL 497B as applicable. Surge protection devices in target emplacements shall be auto-resettable and fuses shall not be installed in target emplacements. Surge protection devices in the master target data panel and the target data panel shall be limited in physical size such that they can be installed in a 5” wide X 6” long X 6” deep space. Surge protectors are not required in SIT clusters where cable lengths do not exceed 30 meters and cables are installed in metallic conduit that is properly grounded at each end.

Testing:

Target Emplacement Power Cable. All secondary power cables for targetry emplacement feeders must be tested by the construction contractor after installation in order to verify that the cables are functional and comply with construction contract requirements. All testing must be performed with equipment approved by the contracting officer. The construction contractor is required to supply all equipment, labor, and materials needed for the tests. All test data and results shall be recorded and listed in the specifications as a submittal requiring Government approval. Examples of minimal tests to be recorded but not limited too, shall be:

- a. Continuity of each conductor (shorted or open).
- b. Megger each conductor to the shield and to each other.
- c. Megger the shield to ground (earth).

Target Data (Fiber Optic/Copper) Cable. All data cables for targetry must be tested by the contractor after installation in order to verify that the cables are functional and comply with construction contract requirements. All testing must be performed with equipment approved by the contracting officer. The construction contractor shall supply all equipment, labor, and materials needed for the tests. All test data and results shall be recorded and listed in the specifications as a submittal requiring Government approval. Examples of minimal tests to be recorded, but not limited too shall be:

- a. Fiber Optic:
- b. Attenuation (End-to-End) One direction
- c. Bandwidth
- d. Copper
- e. Continuity
- f. Shorts between two or more conductors
- g. Transposed pairs.
- h. Reversed pairs.
- i. Split pair
- j. Shield continuity
- k. Grounded conductor

Grounding: Grounding is required for safety and lightning protection at each downrange equipment location. The communication rack ground points shall be connected to ground with at least a No.6 AWG, insulated, stranded, copper cable. Any additional communication racks should be bonded together with the same type and size copper ground. A 19mm (3/4inch) by 3,050mm (10feet) copper-clad steel ground rod shall be driven to a depth of 305mm (1 foot) below finished grade at each equipment location. Each piece of equipment (TDP, LC, Target mechanism, etc.) shall be connected to the ground rod with a dedicated, bare, 6 American Wire Gauge (AWG) copper wire. Grounding within the target emplacements requires the armor of the fiber optic cable and the shield of the CAT 5E or better data cable to be grounded to the MTDP's ground bar or the TDP's ground bar. The design shall ensure all existing or new underground mechanical systems are grounded according to the NEC guidelines.

Telephone: Telephone service is not required at ranges where two other forms of communication are available. Coordinate telephone service with the installation Directorate of Information Management (DOIM).

Range Lighting: There is not an Army standard for the lighting system, the designer will need to ensure that the customer's lighting requirements are met. Contact installation G3 for night operations range lighting requirements. Ranges required for night operations must be designed with red and white lighting in all facilities to be used at night. Protected switching must also be provided to prevent accidental illumination of white lights during night operations. Where necessary low-level in-ground lights (similar to airfield markers) may be used for vehicle parking areas and walkways.

Range Markers: See the section, “Signage - Small Arms” in this document.

Cameras: See the section, “Cameras” in this document.